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Possible procedures and statistical analyses which may be employed in carrying out utilization studies are suggested. All types of facilities are grouped into two categories, instructional and non-instructional. Inventory, analysis, and planning are suggested as phases for a facilities utilization study. Facilities survey forms are included for classrooms and teaching laboratories, armories, field houses, gymnasia, assembly halls, auditoriums, theaters as well as summary forms. (HH)

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Student Populations Against Construction Economics

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Presented at the
Fifth Annual Meeting
of the
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Lost in Space is the title of a currently popular television network program. That same phrase may also be significantly expressive and appropriately descriptive of the dilemma of those schools, colleges, and universities that are literally and figuratively "lost" as to what to do about their own SPACE problems -- the enigma of Student Populations Against Construction Economics.

Much of the "hurry up and build" predicament in which institutions of higher learning have been engaged during the 1960's has been a result of a relatively sudden and sharp student population explosion which caught administrators without the technology, hardware, or software to meet the situation effectively.

Even today, EDP personnel assert that the magnitude of the space problem has not been defined in sufficient depth for computerized programs to be of significant assistance in the near future. Yet, between 1975 and 1980, college and university enrollments may reach the 8,000,000 figure, or more than half again the presently estimated total enrollment of students in institutions of higher learning in this country.

A recent survey directed by the Ford Foundation Educational Facilities Laboratory estimated that for each additional student enrolling in a college or university as much as $3500 may be expended for physical facilities. Of this amount, $1500 would be earmarked for classroom and teaching laboratories, and $2000 would be spent for auxiliary, research, or residential areas, replacement or renovation of obsolete and inadequate facilities, and for other similar purposes.

On the basis of this $3500 per student estimated expenditure, and assuming that some 3,000,000 additional students may enter college within the next decade, the capital outlay required for physical facilities alone could amount to more than $10,000,000,000.

Carefully planned and well executed facilities utilization studies may, therefore, be of prime significance and importance in (a) evaluating existing facilities; (b) analyzing the means by which existing facilities can be utilized to more nearly optimum capacity; and (c) developing systematic approaches toward the expansion, renovation, or remodeling of the existing physical plant. One of the primary purposes of this presentation is to suggest some of the possible procedures and statistical analyses which may be used in carrying out meaningful utilization studies.

For some of the smaller schools and colleges the highly technical and sophisticated programs written for high speed, electronic computers may not only be too costly but unnecessarily complicated. Accordingly, what is being suggested here may be programmed for the computer if it is desired to do so. For those institutions having no such equipment at their disposal, or for whom it may not be an economically sound investment, satisfactory studies may be made by individuals with little or no technical background in the field, with economy of time, effort, and cost as major considerations, and with the only actually required "tools" being paper, pencil, patience, and perseverence.

Any comprehensive facilities utilization study encompasses all types of facilities and all aspects of the number and classifications of those facilities; not just classrooms and teaching laboratories. The purposes and objectives of utilization studies should be not only of immediate concern but also of long range development value.

There are numerous definitions as to what constitutes a classroom, a teaching laboratory, an accessory service room, an assembly hall, a recreation room, or an exhibition hall, to name only a few of the various types of facilities commonly found on a college or university campus. The United States Office of Education is currently attempting to update and rewrite a handbook on Data and Definitions in Higher Education. It is hoped that, for comparative analysis purposes among other reasons, some agreement may be reached by institutions of higher learning as to what constitutes at least the more general characteristics of the several major types of physical facilities in colleges and universities.

In so far as this presentation is concerned, all types of facilities have been grouped under two basic categories -- instructional and non-instructional. Included among the instructional areas are such facilities as: general classrooms, teaching laboratories, armories, art studios, auditoriums, conference rooms, exhibit rooms, gymnasia, libraries, museums, music practice rooms, and theatres.

The non-instructional grouping includes such facilities as: cafeterias, dining halls, snack bars, lounges, residence halls, stairs and stair halls, lobbies, corridors, book stores, student unions, elevator shafts, escalators, loading platforms, receiving areas, service chutes, fire towers, mechanical equipment rooms, air duct shafts, storage closets, storerooms, tunnels, bridges, mail rooms, animal quarters, and communication centers.

Almost immediately it becomes apparent that disagreements on classifications exist. Any coding system, therefore, is likely to become detailed and complex if every type of physical facility is to be specifically categorized. Because of the complexity of the total problem, the material included in this presentation has been designed primarily for the tabulating of data pertaining to classrooms, teaching laboratories, armories, auditoriums, assembly halls, gymnasia, and theatres.

Depending upon the facility under study, however, the analysis sheets (Figures 1 to 5) included here for "instructional" facilities may require only relatively minor modifications in order to adapt them to residential, service, or any of the other

instructional or non-instructional classifications of physical facilities normally associated with a school, college, or university environment.

Any facilities utilization study seems to divide itself almost automatically into three major considerations:

1. INVENTORY

   the compilation of accurate data as to what is available, the physical condition of existing facilities, and the prevailing utilization rate of those facilities;

2. ANALYSIS

   the computing and analyzing of the inventory in order to ascertain whether present facilities are being utilized to optimum advantage. (Optimum utilization and maximum utilization are not necessarily synonomous terms);

3. PLANNING

   based upon inventory and analysis, consideration may then be given to what specific additional facilities are likely to be required, and in what order of priority such facilities should be constructed.

First, then, what is available?

Using a format such as the suggested Facilities Survey Form (Figure 1 for Classrooms and Teaching Laboratories; Figure 2 for Armories, Field Houses, or Gymnasia; and Figure 3 for Auditoriums, Assembly Halls, and Theatres), a record may be compiled of the general characteristics of each facility under consideration.

In the case of classrooms and teaching laboratories (Figure 1) such factors may be included as: type of room, type of seating, seating capacity, square feet in the total area, square feet per student station, number of feet of blackboard space, availability of visual aids (including television), any fixed or special equipment in the room which may be an integral

factor affecting the possible utilization of that particular facility, and whether any academic discipline shall be accorded "priority privileges" in the assignment of classes to that particular facility.

The detail items in Figures 2 and 3 respectively would be somewhat similar in nature, but would include those factors peculiar to gymnasia, field houses, armories, auditoriums, theatres, etc.

Equally important to the number, types, and sizes of facilities available is to determine which ones are "adequate" by what might be defined as minimum or reasonable standards. The physical condition of any facility may have as much bearing upon its optimum utilization as does its seating capacity, location, etc. Only with total information readily available can planned programs of renovation or remodeling for more efficient utilization be systematically developed. By the same token, improvement of existing facilities may have a considerable effect upon the immediate or long range need for additional construction.

Of possible concern are such "instructional features" as: electrical outlets, lecterns, map hooks and rails, platforms, seating arrangements, and the writing surfaces of the tablet arm chairs or tables in the room. Such "physical features" as: acoustics, air conditioning, dimmers, eye-level peek holes in doors, fire resistancy, condition of floors, heating, lighting, ventilation adequacy, outside noise interference, paint, proximity to related facilities, and window placement, among others, may affect the overall usability of any given area.

How well are existing facilities being used?

With the Facilities Survey Form as the source document, the appropriate data may then be compiled into a concise, understandable, and readable format for ready reference purposes.

For example, the following INVENTORY OF CLASSROOMS AND TEACHING LABORATORIES (See also Figure 4) is a summary statement of the number of such rooms available by seating capacities:

INVENTORY OF CLASSROOMS AND TEACHING LABORATORIES

SEATING CAPACITY	CLASS ROOMS	LABORA-TORIES	%-AGE CLASS ROOMS	%-AGE LABORA-TORIES	TOTAL	%-AGE
Up to 30	78	183	32.3	73.5	261	53.3
31 - 50	79	44	32.6	17.7	123	25.2
51 - 75	33	9	13.6	3.6	42	8.7
76 - 100	23	6	9.5	2.4	29	6.0
101 - 200	16	5	6.6	2.0	21	4.3
Above 200	13	2	5.4	.8	15	2.5
TOTAL	242	249	100.0	100.0	491	100.0

The significance of the "percentage column" in the preceding summary document may not be immediately apparent. The table below, which compares course enrollments with the physical facilities inventory analysis, points up one of its possible uses.

COMPARISON OF COURSE ENROLLMENTS WITH ROOM CAPACITIES

CLASS SIZE	NUMBER OF COURSES	%-AGE	CLASSROOMS & LABORATORIES	
			NUMBER	%-AGE
Up to 30	1797	72.3	261	53.2
31 - 50	496	20.0	123	25.0
51 - 75	102	4.1	42	8.6
76 - 100]	30	1.2	29	5.9
101 - 200	43	1.8	21	4.3
Above 200	16	.6	15	3.0
TOTAL	2484	100.0	491	100.0

If, as indicated by the two tables on page 5, the percentage of courses with enrollments of 31 to 50 students each (20.0%) approximates the percentage of available rooms of similar capacity (25.0%), there is reason to believe that the existing facilities in this capacity range could be used to nearly optimum advantage.

On the other hand, if 72.3% of all courses given had enrollments of fewer than 30 students each, but only 53.2% of the available classrooms and teaching laboratories were of 30 capacity or less, it seems quite apparent that rooms of somewhat larger than necessary capacity must have been used to accommodate small enrollment classes. In a continuing situation of this nature it would be a matter of administrative decision as to what might be done economically to utilize existing facilities to better advantage.

It is one thing to know the number of periods per week during which any given classroom or teaching laboratory is in use. It is equally significant to be aware of the intra-room utilization situation during any given period, day, or average week. In other words, how many student stations remain unoccupied in a given room even though that particular room may be "in use."

For that purpose a format similar to the analysis sheet entitled ROOM AND STUDENT STATION UTILIZATION SUMMARY (figure 5) might be developed. Again, adaptations of this particular form may be devised for surveying areas other than classrooms and teaching laboratories.

The suggestions included here are necessarily general in nature, and have been designed to cover more or less normal conditions. Individual situations may require individual techniques.

What findings may result from the use of inventory analysis and utilization surveys similar to those proposed here?

1. The number of additional students who might be accommodated in existing facilities may be significantly larger than would have been presumed possible without such analyses having been compiled;

2. Utilization rates, and particularly intra-room utilization rates, are likely to be somewhat lower than administrative officers may be aware (or care to admit);

3. Colleges and universities tend to construct classrooms and teaching laboratories in considerably greater quantity, as well as in larger sizes, than the number and sizes of classes scheduled in them may require.

To cite one example of the possible extent of an overbuilding trend, the July 17, 1964, issue of Time magazine carried an article entitled, "Advice From a Wise Old Computer." The writer of this article asserted that a typical junior college of 4500 students normally required 142 classrooms, but stated that a junior college soon to be built would accommodate this same number of students in 80 classrooms - a decrease of 43.7%.

The article explained that technicians at McDonnell Automation Center, St. Louis, Missouri, using techniques employed by aerospace engineers to simulate the performance of a space capsule, fed data into an IBM 7094 computer which included the curriculum of the college, program of course offerings, sizes of classrooms and teaching laboratories, size of the faculty, and required schedules for students. The computer produced a schedule that utilized instructional areas for 80% of a 45 hour week, as compared with what Time magazine declared was an average national utilization average of 30% to 50%.

Acting upon the basis of that computer run, building plans for this particular junior college were reduced by 100,000 square feet, and at an estimated financial savings of approximately $3,000,000.

Was due and sufficient allowance made for out-of-phase students, curriculum adjustments, course adds, course drops, flexibility in class sizes, conflicts in faculty or student schedules, leaves of absence, or any of the numerous other factors which may affect demands upon and maximum or optimum utilization of physical facilities? Time (both Father and the magazine) may reveal some interesting answers.

When do additional facilities become an absolute necessity?

There is probably no one answer, under any and all possible conditions and for all types of institutions, regardless of size, locale, resident or day student oriented, whether public or private supported, etc., as to when demands reach the saturation point and new construction becomes inevitable.

A number of the specialists in the field of physical facilities planning and utilization seem to concur, however, that even under the most ideal conditions, and including a nearly perfect distribution of enrollments, courses, meeting periods, class sizes, etc., any school, college, or university is likely to find itself with serious problems if the seating capacity of its classrooms and teaching laboratories falls below approximately two-thirds of the total number of full-time students enrolled.

TO BUILD OR NOT TO BUILD -- that is the question.

While no claim is made toward answering that question in its entirety, it is hoped that this presentation may have suggested certain alternatives to that of being forced into a costly or unwise building program as the only solution to a long range development program.

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FACILITIES SURVEY FORM
(Classrooms and Teaching Laboratories)

_____ room and building

_____ code designation

DESCRIPTIVE DATA

TYPE OF ROOM	___ General Purpose ___Specialized (_____ type) ____Teaching Laboratory (_____ type) ___ Priority Assignment (_____ department)
SIZE	AREA: _____ length X _____ width _____ square feet SEATING CAPACITY _____ SQUARE FEET PER STUDENT STATION _____
TYPE OF SEATING	___ FTA ___ LTA ___ T & C ___ STOOLS ___ OTHER (specify) _____
BLACKBOARD SPACE	___ FIXED _____ number of feet ___ PORTABLE _____ X _____ size ___ TACKBOARD _____ number of feet
VISUAL AIDS	___ PROJECTOR ___ SCREEN ___ SHADES ___ TV ___ P. A. SYSTEM ___ _____ ___ _____
SPECIAL EQUIPMENT (list)	_____ _____ _____
REMARKS	

FIGURE 1

FACILITIES SURVEY FORM (Classrooms and Teaching Laboratories)

INSTRUCTIONAL FEATURES	EVALUATION	PHYSICAL FEATURES	EVALUATION
BLACKBOARDS		ACOUSTICS	
ELECTRICAL OUTLETS		AIR CONDITIONING	
LECTERN		EYE LEVEL PEEK HOLE IN DOOR	
MAP HOOKS AND RAILS		FIRE RESISTANCY	
PLATFORM		FLOORS	
POINTER		FURNITURE	
SEATING ARRANGEMENT		LIGHTING	
SQUARE FEET PER STUDENT STATION		OUTSIDE NOISE INTERFERENCE	
TACKBOARDS		PAINT	
TV		PROXIMITY TO OTHER AREAS	
VISUAL AIDS		SHAPE OF ROOM	
WASTEBASKETS		VENTILATION	
WRITING SURFACES OF		WINDOW PLACEMENT	
_ CHAIRS		_____	
TABLES		_____	
_____			
_____			
_____			

__ Continue Use of Room Indefinitely

___Continue Use of Room for Limited Time Only

__ Discontinue Use as Soon as Possible

__ No immediate repairs needed

__ Satisfactory with minor repairs

__ Satisfactory only with major repairs

FIGURE 1

FACILITIES SURVEY FORM

(Armories, Field Houses, Gymnasia, etc.)

room and building _____ code designation _____

DESCRIPTIVE DATA

TYPE OF UTILIZATION	__ Military Instruction __ Air Force __ Army __ Navy __ _____	__ Physical Education __ Instruction __ Intramurals __ Varsity Sports __ _____ __ _____
	__ Men only __ Women only __ Men and women	
SIZE	Main Floor: _____ X _____ Auxiliary Floor: _____ X _____ Lobby: _____ X _____ Ticket Booth: _____ X _____ _____: _____ X _____ _____: _____ X _____	
SEATING CAPACITY	Main Floor: _____ Balcony: _____ Auxiliary Floor: _____ _____: _____	
VISUAL AIDS	__ Projection Booth __ Screen __ TV __ Public Address System __ _____	

FIGURE 2

FACILITIES SURVEY FORM (Armories, Field Houses, Gymnasia, etc.)

SPECIAL EQUIPMENT (list activity or sport below)	EVALUATION	PHYSICAL FEATURES	EVALUATION
ACTIVITY _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ LOCKER ROOMS AND LOCKERS NUMBER OF LOCKER ROOMS __ Men __ Women NUMBER OF LOCKERS __ Men __ Women NUMBER OF SHOWER HEADS __ Men __ Women		ACOUSTICS AIR CONDITIONING FIRE RESISTANCY FLOOR LIGHTING OUTSIDE NOISE INTERFERENCE PAINT PROXIMITY TO RELATED AREAS SHAPE OF AREA FOR ACTIVITY CONCERNED WINDOW PLACEMENT TYPE OF CONSTRUCTION __ Wood __ Masonry __ _____ DATE OF LAST MAJOR ALTERATION _____ OTHER COMMENTS _____ _____ _____	

figure 2

FACILITIES SURVEY FORM

(Assembly Halls, Auditoriums, and Theatres)

room and building _____ code designation _____

DESCRIPTIVE DATA

TYPE OF UTILIZATION	__ Assembly Hall __ Chapel __ Classes __ Dramatic Productions __ _____ __ _____
SIZE	Balcony: _____ X _____ Coat Check Room: _____ X _____ Costume storage and preparation _____ X _____ Dressing Rooms (Men) _____ X _____ (Women) _____ X _____ Lobby: _____ X _____ Main Floor: _____ X _____ Orchestra Pit: _____ X _____ Property Storage and Preparation: _____ X _____ Ticket Booth: _____ X _____ _____: _____ X _____
SEATING CAPACITY	Balcony _____ Main Floor _____ TOTAL _____

Figure 3

FACILITIES SURVEY FORM (Assembly Halls, Auditoriums, and Theatres)

SPECIAL EQUIPMENT	EVALUATION	PHYSICAL FEATURES	EVALUATION
CURTAIN		TYPE OF CONSTRUCTION	
CYCLORAMA		__ Wood	
FLY GALLERY		__ Masonry	
FOOTLIGHTS		DATE OF LAST MAJOR ALTERATION	
LIGHTING PANEL		_____	
ORCHESTRA PIT		ACOUSTICS	
PIPE ORGAN		AIR CONDITIONING	
PROJECTION BOOTH		DEPTH OF STAGE	
PUBLIC ADDRESS SYSTEM		_____	
SCREEN		FIRE RESISTANCY	
STAGE CONTROL BOOTH		FLOOR	
TV		LIGHTING	
_____		OUTSIDE NOISE INTERFERENCE	
_____		PAINT	
_____		SHAPE	
_____		WIDTH OF PROSCENIUM ARCH	
_____		_____	
_____		WINDOW PLACEMENT	
_____		OTHER COMMENTS	
_____		_____	
_____		_____	
_____		_____	
_____			

Figure 3

INVENTORY OF CLASSROOMS AND TEACHING LABORATORIES

SEATING CAPACITY	CLASSROOMS	TEACHING LABORATORIES	PERCENTAGE OF CLASSROOMS	PERCENTAGE OF LABORATORIES	TOTAL	PERCENTAGE
Up to 30						
31 - 50						
51 - 75						
76 - 100						
101 - 200						
201 - 300						
301 - 400						
401 - 500						
501 - 999						
ABOVE 1000						
TOTAL						

FIGURE 4

ROOM AND STUDENT STATION UTILIZATION SUMMARY FORM

room and building _____ seating capacity _____ TERM 19____

CLASS PERIOD	NUMBER OF STUDENT STATIONS OCCUPIED BY CLASS PERIOD AND BY DAYS / NUMBER OF STUDENT STATIONS AVAILABLE BY CLASS PERIOD AND BY DAYS						NO. OF PERIODS USED / NO. OF PERIODS AVAILABLE	%-AGE OF USE	INTRA-ROOM UTILIZATION	
	MON	TUE	WED	THU	FRI	SAT			NO. OF STATIONS OCCUPIED / NO. OF STATIONS AVAILABLE	PERCENTAGE OCCUPANCY PER WEEK AND BY PERIODS
1										
2										
3										
4										
5										
6										
TOTAL										

FIGURE 5